

by M. Chevreux is an attribute of the changed environment. I do not know whether a similar colour characterizes those of other open waters. As to the origin of *Bathyonyx*, however, we have so far no indication of its derivation from subterranean ancestors; and it appears probable, according to Prof. Vejdovský, whose judgment is based upon its general characteristics and the details of its organization, that its progenitors lived in the open waters of Lough Mask and that its present characters are the result of its existence in the lowest depths. My latest researches have also strengthened the probability of his suggestion that a habit of burrowing in mud may have enabled *Bathyonyx* to escape capture by the dredge, which skims the surface of the lake-floor. Nevertheless a considerable amount of mud was subjected to examination on each occasion, which produced nothing but some *N. Kochianus*.

The latter portion of Prof. Vejdovský's paper on the synonymy of

Gammarus Caspary, Pratz,
Gammarus Kochianus, de Rougemont,
Niphargus Kochianus, Vejdovský,
Niphargus Caspary, Wrześniowski,
Niphargus Kochianus, Chilton,

has been omitted.—WM. F. DE VISMES KANE.]

XXXVIII.—*Observations on the Trematode Parasites of British Birds.* By WILLIAM NICOLL, M.A., B.Sc., Gatty Marine Laboratory, St. Andrews.

TOWARDS the end of last spring I had an opportunity of examining several of the commoner species of shore-birds. These were, unfortunately, in most cases not in the best condition for helminthological investigation, as I seldom received them till at least a day after they were killed, when the parasites were almost always dead. The immediate application of weak formalin, however, preserved their anatomical details rather well, although it rendered them unfit for histological work. For this reason important features in some cases are only superficially described, a matter which I hope to improve shortly with the help of better material. These observations are thus to be regarded, to a certain extent at least, as merely preliminary.

The species obtained appeared on a first examination to be all assignable to well-known genera, e. g. *Psilostomum*, *Echinostomum*, *Gymnophallus*, *Tocotrema*, and in particular *Spelotrema*. The frequent occurrence of members of the last-named genus was not surprising, as I had previously found a *Spelotrema* species in great abundance in *Larus argentatus*. A great variety of sizes occurred, but in this respect there were no obvious lines of demarcation to indicate whether one or more species were under consideration. Closer examination proved that not only were there several different species, but that two distinct genera were present. They occurred, as a rule, side by side in the same hosts, occupying the same situations in the intestine and being equally numerous. I have been able to differentiate three distinct species of *Spelotrema*, as well as three species of the other genus, which is new and for which I propose the name *Maritrema*. In addition a new species of *Gymnophallus* and one of *Tocotrema* have to be recorded.

Altogether 16 species of birds were examined. Of these, three, *Urinator lumme*, *Alle alle*, and *Uria troile*, yielded no Trematode parasites. Of the other species 91 per cent. of the examples were more or less abundantly infected. Of the total number of all species 68 per cent. were infected. These figures are very high compared with those of Mühlings*, Hausmann †, and Wolffhügel ‡, but this is perhaps to be accounted for by the fact that I do not include any purely terrestrial birds (in the sense that they do not frequent the sea), which are apparently much less subject to infection than the shore-birds. Other possible explanations are that this locality is more favourable for infection, or that my examination has been more exhaustive than that of the above-mentioned observers.

The absence of Trematode parasites in *Alle alle* and *Uria troile* recalls a similar condition § in *Blennius pholis* amongst fishes. Both these birds are, so far as I know, purely aquatic and feed principally on crustaceans and fish. The shore-birds, on the other hand, live to a large extent on mollusks, as well as fish, the diet being thus in great part different. In the same way the diet of *Blennius pholis*, which subsists on small mollusks ||, differs from that of other

* Archiv f. Naturg. lxiv. p. 58.

† Centralbl. f. Bakter. xxvi. p. 452.

‡ Beitrag zur Kenntnis der Vogelhelminthen (Inaug.-Diss.), 1900.

§ Ann. & Mag. Nat. Hist. (9) xix. p. 68.

|| *Blennius pholis* is also fond of *Balanus*, but the sessile condition of the latter renders it different from other Crustacea.

fish, which feed largely on crustaceans, annelids, and each other. From these and other considerations it would appear that, in the littoral zone, at least, where both have a common feeding-ground, birds derive their Distomid parasites from mollusks*, while fish obtain theirs from crustaceans, annelids, and each other. This seems to afford an explanation of the absence of Distomids in the three above-cited cases.

For ease of reference I subjoin a list of hosts with their respective parasites:—

<i>Alca torda</i> , Linn. Razorbill.	
<i>Tocotrema lingua</i> (<i>Crepl.</i>).	Intestine.
? <i>Spelotrema simile</i> , <i>Jägersk.</i> (juven.).	Intestine.
<i>Larus argentatus</i> , Brünn. Herring-Gull.	
<i>Gymnophallus deliciosus</i> (<i>Olsson</i>).	Gall-bladder.
<i>Maritrema lepidum</i> , sp. n.	Intestine.
<i>Parorchis acanthus</i> , <i>Nicoll</i> .	Bursa Fabricii, rectum, and intestine.
<i>Spelotrema excellens</i> , sp. n.	Intestine and cæca.
(= <i>Sp. simile</i> , <i>Jägersk.</i> , <i>Nicoll</i> .)	
<i>Tocotrema lingua</i> (<i>Crepl.</i>).	Intestine.
<i>Monostomum</i> sp. (juven.).	Intestine.
<i>Larus canus</i> , Linn. Common Gull.	
<i>Parorchis acanthus</i> , <i>Nicoll</i> .	Rectum.
<i>Larus ridibundus</i> , Linn. Black-headed Gull.	
<i>Maritrema gratiosum</i> , sp. n.	Intestine.
<i>Phalacrocorax graculus</i> (Meyer). Shag.	
? <i>Cryptocotyle concavum</i> (<i>Crepl.</i>).	Intestine, cæca, and rectum.
<i>Oidemia nigra</i> (Linn.). Scoter.	
<i>Gymnophallus dapsilis</i> , sp. n.	Bursa Fabricii.
<i>Psilostomum brevicolle</i> (<i>Crepl.</i>).	Intestine.
<i>Spelotrema pygmæum</i> (<i>Levins.</i>).	Intestine.
<i>Oidemia fusca</i> (Linn.). Velvet Scoter.	
<i>Gymnophallus dapsilis</i> , sp. n.	Bursa Fabricii (and ? cæca).
<i>Psilostomum brevicolle</i> (<i>Crepl.</i>).	Intestine, cæca, and rectum.
<i>Spelotrema pygmæum</i> (<i>Levins.</i>).	Intestine, cæca, and rectum.
<i>Monostomum</i> sp.	Cæca.
<i>Pelidna</i> (<i>Tringa</i>) <i>alpina</i> (Linn.). Dunlin.	
<i>Maritrema gratiosum</i> , sp. n.	Intestine.
<i>Spelotrema feriatum</i> , sp. n.	Intestine, cæca, and rectum.
<i>Spelotrema claviforme</i> (<i>Brds.</i>).	Intestine, cæca, and rectum.
<i>Totanus calidris</i> , Bechst. Redshank.	
<i>Maritrema humile</i> , sp. n.	Intestine.

* An important exception to this is the case of some *Spelotrema* species, which are obtained, partly at least, from *Cancer pagurus* and *Carcinus maenas*.

Spelotrema feriatum, sp. n.	Intestine, cæca, and rectum.
Tocotrema jejunum, sp. n.	Intestine.
Monostomum petasatum, <i>Deslongch.</i>	Cæca.
<i>Numenius arquata</i> , Lath. Curlew.	
? <i>Echinostomum secundum</i> , <i>Nicoll.</i>	Intestine, cæca, and rectum.
<i>Vanellus vanellus</i> (Linn.). Lapwing.	
Spelotrema feriatum, sp. n. (juven.).	Intestine, cæca, and rectum.
<i>Egialitis hiaticula</i> (Linn.). Ring-Plover.	
Maritrema gratiosum, sp. n.	Intestine and duodenum.
Spelotrema feriatum, sp. n.	Rectum, cæca, and intestine.
Spelotrema claviforme (<i>Brd.</i>).	Intestine, rectum, and cæca.
<i>Hæmatopus ostralegus</i> , Linn. Oyster-catcher.	
Maritrema gratiosum, sp. n. (juven.).	Intestine.
Spelotrema feriatum, sp. n. (juven.).	Intestine.
<i>Ptilostomum brevicolle</i> (<i>Crepl.</i>).	Intestine and cæca.

GENUS SPELOTREMA, Jägerskiöld.

Spelotrema excellens, sp. n.

= *Sp. simile*, Jägersk., Nicoll, Ann. & Mag. Nat. Hist. (7) xvii. pp. 522-524.

From other members of the genus this species is distinguished by its comparatively large size. In a former note I commented on the great difference in size between my specimens and those of *Sp. simile*, obtained by Jägerskiöld from the same host. Beyond this I could find no difference of sufficient importance to warrant specific distinction, and the occurrence of the two forms in the same host was a reason for regarding them, if not identical, at least merely as two varieties of the same species. It not uncommonly happens, however, that two or even more species of the same genus inhabit the same host.

Jägerskiöld found a similar difficulty in distinguishing between his form and *Sp. pygmaeum* (Levins.). The two forms are nearly of the same size and practically the only differences between them consist in the reversed ratio of the suckers, which, however, are very nearly equal, and in the size of the "genital body." It is to these features that I, also, am obliged to turn, in order to obtain marks to differentiate my specimens.

Since first obtaining this form I have met with it several times again, always in *Larus argentatus*, never in any other host. Renewed observations and measurements confirmed

those previously noted, except in one respect, the relative sizes of the suckers. This is by no means an easy matter to decide, for, the suckers being very nearly equal, slight contraction on the part of either is sufficient to cause it to appear smaller. In addition, owing to the method of preservation, it frequently happens that one or both suckers are deformed, *i. e.*, elongated in one direction or another. From previous measurements it was concluded that the ventral sucker was, if anything, slightly larger than the oral sucker, thus agreeing with Jägerskiöld's observations. A further extended series of measurements has caused me to alter that opinion. In a considerable number of cases I have found the suckers almost exactly equal, and in all other instances, except one, the oral sucker exceeded the ventral to a greater or less extent. This is perhaps the most essential difference between *Spelotrema excellens* and *Sp. simile*, Jägersk., apart from the diversity in size. Other possible features of distinction, such as the size of the genital body, the length of the ductus ejaculatorius, and the situation and shape of other organs will be referred to later.

In most respects my previous description is fairly accurate, but several features, the importance of which I did not then realize, were overlooked. In describing the shape, exception was taken to Jägerskiöld's term "biscuit-förmig." This term is occasionally used by continental observers; it is not very accurate, although it may be apt enough as understood by them. I preferred the term "club-shaped," but that was in reference more to the outline than to the actual body-form, in the same sense, I believe, as Brandes used the specific name *claviforme*. I can imagine no satisfactory general term to describe this shape, which is almost peculiar to the genus. If the outline were made to revolve on its long axis a club-shape would be evolved; in reality, however, there is a very considerable amount of dorso-ventral flattening, particularly in the anterior part of the body, which is extended, and the sides of which display a tendency to curl up ventrally. The presence of the large number of ova causes a bulging in the posterior part of the body, which, moreover, has an elliptical or almost circular outline. In describing *Sp. pygmaeum* (Levins.), Odhner* uses the term "keulen-förmig" and adds that in contracted conditions the breadth increases gradually from before backwards. This would involve a somewhat triangular

* Fauna Arctica, iv. (2) pp. 315-316.

outline, much as Levinsen found it. Such a form is rarely, if ever, met with in *Sp. excellens* or *Sp. simile*. In contraction the anterior part of the body becomes broader, almost as broad as the posterior part, but it is always separated from the latter by a distinct constriction about the level of the intestinal bifurcation.

In my second series of measurements, specimens were found varying in length from .71 to 1.39 mm., the average being .91 mm. The maximum breadth of the anterior part of the body is .23-.37 mm.; at the constriction .21-.28 mm.; posteriorly .37-.49 mm. The average of these is .29, .24, .41 mm., being nearly in the proportion 5 : 4 : 7, and a large number of examples were found to vary very slightly from these average figures. Both suckers are small and feebly developed: the oral sucker measures .068-.086 mm. in diameter, the ventral sucker .062-.081 mm.; average .076 mm. and .071 mm. respectively, a ratio of nearly 15 : 14. The maximum limit .095 mm. previously quoted for the ventral sucker is apparently abnormal. The ventral sucker is situated at a distance of rather more than $\frac{1}{3}$ of the body-length from the posterior end, and if it be regarded as marking the boundary between the anterior and posterior parts of the body, the ratio between the two is approximately 5 : 3.

The pharynx measures .037-.062 \times .026-.044 mm., and the prepharynx is about $\frac{3}{4}$ as long. The œsophagus is narrow and may be any length from .20 mm. to .45 mm. The diverticula are about $\frac{2}{3}$ of that length; they are dilated and extend back as far as the level of the centre of the ventral sucker. In a few cases they stop short of, or exceed, this limit, but the variation in this respect is slight.

Odhner pointed out a distinction between *Spelotrema pygmaeum* and *Sp. simile*, which escaped Jägerskiöld's notice. In the latter species the base of the genital body is much larger proportionately than in the former. In *Sp. excellens* it is still larger in comparison with the size of the ventral sucker. It measures .050-.065 mm. in diameter, *i. e.*, about $\frac{4}{5}$ the diameter of the sucker. It is situated on the left side of, and close beside, the ventral sucker, which it occasionally overlaps, and it is on a level with the centre of the sucker or, as often as not, a little in front of or behind this. The vesicula seminalis lies in the middle line or a little to the right, immediately in front of the ventral sucker, sometimes slightly overlapping it dorsally. Its outline is elliptical, the long axis being directed obliquely forwards; size .09-.11 \times .07-.08 mm. The ductus ejaculatorius, issuing from its

anterior end, is not convoluted to the same extent as in *Sp. simile*: its course is, in fact, almost direct, albeit slightly sinuate, towards the genital body. This difference may be of specific importance. The testes are shaped and situated exactly as in *Sp. pygmæum**, not as represented in my figure. The outline is oval with the long axis directly transverse. They are usually enveloped to a large extent by the uterus. The right testis is just behind the ovary, while on the left the anterior border of the testis is almost contiguous with the genital sucker. They measure $\cdot 14\text{--}\cdot 16 \times \cdot 08\text{--}\cdot 11$ mm. The ovary is on the right of the ventral sucker and is contiguous with it, the right intestinal diverticulum, and sometimes the vesicula seminalis. Its shape is somewhat variable, being pear-shaped, oval, or more irregular, but in all cases the long axis is directed obliquely downwards to the middle line of the body; size $\cdot 10\text{--}\cdot 11 \times \cdot 07\text{--}\cdot 08$ mm. The uterus starts from the posterior end of the ovary, and passing down the middle of the body forms a series of convolutions first on the right side and then on the left. The convolutions are so voluminous that no regular arrangement is apparent. The uterus fills practically the whole of the posterior part of the body not occupied by the testes and yolk-glands. Its anterior limit is the level of the anterior border of the ventral sucker. The ova are very numerous, colourless on the right, bright yellow on the left. This would appear to be a further point of distinction between this species and *Sp. simile*, for, according to Odhner, the ova in the latter are all colourless, a feature serving to distinguish it from *Sp. pygmæum*, in which the condition is the same as in *Sp. excellens*. The ova measure $\cdot 023\text{--}\cdot 025 \times \cdot 010\text{--}\cdot 013$ mm. The yolk-glands are difficult to make out, being obscured by the ova. They lie behind and ventral to the testes, which they overlap to some extent. They appear to consist of a number of lobes on each side, but the arrangement and the exact number of the lobes I am unable to determine with certainty. Comparison with *Sp. pygmæum* and the next species to be described would point to their number being about eight on each side. The yolk-ducts are usually visible, uniting just behind the ventral sucker, the common duct passing towards the ovary.

Spelotrema feriatum, sp. n.

This species occurred very numerously in *Pelidna alpina*, *Totanus culidris*, and *Ægialitis hiaticula*, less frequently and

* Odhner's figure, *loc. cit.*

only in immature condition in *Hæmatopus ostralegus* and *Vanellus vanellus*. In every case the habitat is towards the lower end of the intestine, the cæca, and the rectum. Occasionally a few were found as far forward as the duodenum.

It is readily distinguished from the other species of the genus by several well-marked features. The body does not display the familiar club-like outline, it has more that of a pointed oval, the posterior end being rounded. There is no marked constriction. The examples from *Vanellus* are bluntly oval, presenting the appearance of a species of the genus *Gymnophallus*, from which they are certainly hard to distinguish in their immature condition*.

In point of size it is midway between *Sp. simile* and *Sp. excellens*, the observed limits in length being ·66–·91 mm.; average ·77 mm. In a specimen of average length the maximum breadth is ·36 mm., and is found at the level of the ventral sucker or a little behind it. The oral sucker is of large size, measuring ·09 mm., and is considerably greater than the ventral sucker, which has a diameter of ·075 mm. The ratio is 6 : 5. The ventral sucker is almost exactly a third of the body-length from the posterior end. The pharynx has an average length of ·065 mm., and the prepharynx is about as long, but it varies with the state of extension. The œsophagus measures ·12 mm. in length and the diverticula ·28 mm. Thus the latter are nearly $2\frac{1}{2}$ times as long as the œsophagus, in marked contrast to the condition in *Sp. excellens*. Moreover, they extend as far back as the posterior border of the ventral sucker, and they are not dilated.

The genital body, situated close to the left side of the ventral sucker and rather behind the level of its centre, is comparatively small, measuring only ·040 mm. in diameter at the base. The vesicula seminalis is a large ovoid, sometimes almost globular body, lying well to the right side of

* From later observation I am inclined to suspect that more than one species is under consideration here. What must be regarded as the typical specimens occur particularly in *Pelidna* and *Ægialitis*, and they present some features which are not met with in the other members of the genus. These features I have not touched on above, as I at first considered them to be abnormal; they are as follows:—The body has a distinct brownish colour, due to the presence of some pigment. The excretory system is mapped out with surprising distinctness in a series of intensely black lines, the configuration of which is much as in Jägerskiöld's figure (Centralbl. f. Bakter. xxvii. p. 734, fig. 2), but, in addition, numerous fine anastomosing tubules are also visible. Finally, there is a roundish structure, enclosing apparently two small ovoid bodies, situated between the genital body and the left intestinal diverticulum. Of the function of this structure I have at present no knowledge.

the middle line. It is thus not entirely in front of the ventral sucker, with which it is contiguous. Its long axis is obliquely transverse and the ductus ejaculatorius issues from its left end and passes round in front of the ventral sucker in almost direct course to the genital body. The testes are situated as in the preceding species. The ovary is a regularly ovoid body, with its long axis transverse and slightly depressed towards the middle line. It is on the level of the posterior border of the ventral sucker and is thus further back than in *Sp. excellens*. From it the uterus passes down the middle of the body towards the left side; it then runs round the posterior edge of the body to the right side, where it forms a few convolutions. Pursuing a transverse zigzag course it returns to the left side, almost reaching the outer edge of the body, whence it bends back again and passes forward to the genital sucker. Its topography is thus entirely different from that in *Sp. excellens*. In addition the ova are almost colourless or of a very dull hue. They measure $\cdot 020\text{--}\cdot 025 \times \cdot 010\text{--}\cdot 012$ mm. The uterus is of very limited extent and does not extend in front of the testes. The yolk-glands can thus be easily made out. They occupy the usual position ventral to and a little behind the testes. In an immature specimen their lobed structure can be distinctly seen. In *Sp. simile* Jägerskiöld figures six lobes on each side. Odhner corrects this to eight for both *Sp. simile* and *Sp. pygmaeum*. In *Sp. feriatum*, however, there seem to be seven lobes on the left side and eight on the right. Should this be the normal condition it would be analogous to that in some of the Hemiuridæ, in which there are three lobes or tubes on the left and four on the right. The arrangement of the lobes is characteristic and apparently fairly constant. In each group there is a central lobe of roughly quadrilateral outline; the sides of this form, as it were, facets into which the other lobes fit. The latter are all of quadrilateral or wedge-shaped outline, broadest at their distal ends, with rounded corners. The anterior face of the central lobe and each of the lateral faces accommodates a single lobe, while behind there are three lobes in the left vitellarium and four in the right. I have observed the odd number of lobes on the left side in all the specimens examined, but it is possible that an additional lobe may be obscured. From Odhner's figure there appears to be no such regular formation of the lobes in *Sp. pygmaeum*. Jägerskiöld* represents a regular arrangement, but there is no central lobe.

* Centralbl. f. Bakter. xxvii. p. 733, fig. 1.

Spelotrema claviforme (Brandes).

Distomum claviforme, Brandes, Archiv Naturg. liv. p. 247, pl. xvii. fig. 1.

In *Pelidna alpina* and *Ægialitis hiaticula* there occurred a very large number of examples of a species which I am obliged to identify as *Distomum claviforme*, Brds., despite its author's unsatisfactory description. Brandes's note on the species is meagre and his figure is erroneous in its most important feature. It has hitherto not been redescribed. It has been alluded to, however, by Lühe* and Jägerskiöld †, both of whom were much of opinion that the species must be regarded as unidentifiable, except by the author himself. In a footnote Jägerskiöld advances the supposition that it might be included in the genus *Levin-enia* (= *Spelotrema*) and gives an interpretation of Brandes's figure in this light. I previously found occasion to agree with this interpretation and my present discovery shows how correct it is. Admitting its correctness, however, there remain three or four errors in Brandes's figure; the oral sucker is smaller than the ventral, the posterior testes (= the genital body) is much too large, and the ova are proportionately far too small. The whole drawing is of a sketchy nature ‡, so that too much weight need not be attached to these discrepancies.

The majority of my specimens exhibit the typical club-like outline in a marked degree. The anterior and posterior parts of the body are always separated by a constriction which occurs about the level of the intestinal bifurcation. The cuticular scales extend exceptionally far back (to the level of the testes at any rate). The length of the body never exceeds .40 mm. and may be as small as .23 mm. Immature specimens were never observed. The maximum breadth (posteriorly) is on an average .17 mm., while anteriorly the breadth is usually about .13 mm. As in *Sp. pygmæum*, the oral sucker is greater than the ventral, but the difference is here more pronounced. They have respectively an average diameter of .038 mm. and .031 mm. The ventral sucker is at a distance of slightly less than a third of the body-length from the posterior end. The pharynx measures .020-.025 × .010-.013 mm.; the prepharynx is about the same length as the pharynx, but it may be considerably longer or shorter. The œsophagus has

* Zool. Anzeig. xxii. p. 537.

† Centralbl. Bakter. xxvii. p. 739.

‡ As witness the representation of the uterus as a continuous tube having neither beginning nor end.

an average length of $\cdot 12$ mm., but it varies very much with the state of extension or contraction; the diverticula are almost constantly $\cdot 08$ mm. long. The latter are dilated, very wide apart, and do not nearly reach the level of the ventral sucker. In *Sp. pygmaeum* they extend as far back as the posterior border of the sucker.

The genital body is situated close to the left side of the ventral sucker, on a level with its anterior half. It is of small size, the basal diameter being only $\cdot 013$ – $\cdot 014$ mm. The vesicula seminalis is transversely oval and lies symmetrically in the intestinal bifurcation, a considerable distance in front of the ventral sucker. The ductus ejaculatorius is slightly sinuate. The ovary is also correspondingly far forward. It is an irregularly rounded body and is not contiguous with the ventral sucker, the vesicula seminalis, or the right intestinal diverticulum, as is the case in *Sp. pygmaeum*, where it is of much greater size. The uterus occupies most of the posterior part of the body and extends forward on each side to the end of the intestinal diverticula. The ova are fairly numerous and of comparatively large size, $\cdot 020$ – $\cdot 024 \times \cdot 011$ – $\cdot 014$ mm. They are colourless on the right, bright yellow on the left. The uterus completely envelops the testes and yolk-glands, so that these organs can hardly be seen. This is probably responsible for Brandes's mistake. The testes have much the same situation, but are not nearly so large as those in *Sp. pygmaeum*. The yolk-glands are behind and ventral to the testes, but division into lobes, if such, indeed, be their condition, is not distinctly marked.

From the foregoing it is apparent that in point of size, and possibly on the whole, *Sp. claviforme* approaches most nearly to *Sp. pygmaeum*. Several differences have already been indicated, but they may be briefly recapitulated as follows: cuticular scales are more extensive; suckers are more unequal and the ventral sucker is further back; surrounding structures are thus relatively further forward; intestinal diverticula shorter compared with oesophagus; genital organs all smaller; uterus more voluminous, enveloping the testes*.

* A conclusive proof, which I previously neglected to adduce, that *Sp. claviforme* is not, as Brandes thought, the adult of the cercaria described by McIntosh from *Carcinus maenas* (Quart. J. Micr. Sci. 1865, p. 201) is the fact that this cercaria measures $\cdot 5 \times \cdot 2$ mm. (approx.). It must therefore be the larva of some larger species. A much more likely cercaria is that described by Miss Lebour (Northumberland Sea Fish. Rept. 1905, p. 6) from *Littorina rudis*, if it is not an antecedent stage of the above. It is much smaller in size ($\cdot 25$ mm.), but it has rather long intestinal diverticula.

In addition to the above-mentioned species I have found species of *Spelotrema* in *Alca torda*, *Oidemia fusca*, and *Oidemia nigra*, but their identity is doubtful. From *Alca* only one immature example was taken; it apparently agrees most closely with *Sp. simile*. Its length is .53 mm., maximum breadth .29 mm.; outline club-like; oral sucker .053 mm., ventral sucker .050 × .056 mm.; undivided intestine .22 mm., diverticula .17 mm., reaching centre of ventral sucker; genital body on level of posterior half of sucker, not very large. Ovary on same level as sucker, pear-shaped; testes transversely oval; yolk-glands almost clear of the testes, lobed but not well developed.

The species from the scoters is in all probability *Sp. pygmæum*, which Jameson* has already found in Britain in the black scoter. I found it in great numbers throughout the intestine of *Oidemia fusca*, not so numerously in *O. nigra*. The specimens were unfortunately destroyed before they were thoroughly examined, but from notes made at the time of collection some idea of their nature is to be gained. Length up to .50 mm., breadth .24 mm.; oral sucker .044 mm., ventral sucker slightly less; pharynx .025 × .022 mm.; ova .023–.025 × .014 mm. These figures agree more nearly with *Sp. pygmæum* than with *Sp. claviforme*, which can be the only two species in question.

Genus TOCOTREMA, LOOSS.

Three species have already been ascribed to this genus, viz., *T. lingua* (Crepl.), *T. concavum* (Crepl.), and *T. Muehlingi* (Jägersk.) (= *Dist. lingua*, Crepl., Mühling). They do not, however, appear to form a very homogeneous group. *Tocotrema lingua* and *T. concavum*, though agreeing in the possession of a genital sucker which includes the degenerate ventral sucker, differ in several important features, which appear to demand a generic separation. Although it is true that both possess a genital sucker, the structure of this organ is not at all similar in both. The peculiar "kegel-förmiges Körper" described by Jägerskiöld † in the sucker of *Tocotrema lingua* is not even hinted at by Mühling ‡ in his description of *Distomum concavum*. It may be concluded that such a structure is not present in the latter species, for its presence could not fail to have been noted by Mühling. My specimens of an almost identical form show no appearance on external examination of such a body, but as I

* Proc. Zool. Soc. 1902, i. p. 158.

† Bergens Mus. Aarbog, 1898, ii. p. 10.

‡ Arch. f. Naturg. lxiv. pp. 80-83.

possess no sectional preparations this evidence is not conclusive. The ventral sucker in *Tocotrema concavum* appears to be in a more degenerate condition than in *T. lingua*. Moreover, the voluminous vesicula seminalis of the latter is very much reduced in the former. A less important difference is the symmetrical arrangement of the testes in *Tocotrema concavum* in contrast to the oblique arrangement in *T. lingua*.

The occurrence here of a new species agreeing very closely with *Tocotrema lingua* accentuates the difference between the latter and *Distomum concavum*. Moreover, considering the large number of hosts from which *Distomum concavum* has been recorded, it is quite possible that two or more closely similar species may have been confused. The form which I have obtained from *Phalacrocorax graculus* is almost identical with *Distomum concavum*, but it differs from Mühlhng's description in one or two important features, which may cause it to be regarded as distinct. *Distomum Muehlingi* shows considerable resemblance to *Tocotrema lingua*, and if it should prove to have a genital sucker, as opposed to Mühlhng's description, it would be classed in the same group. For these reasons I am inclined to regard *Distomum concavum* as the type of a genus distinct from, but closely related to, *Tocotrema*. To this genus Lühe's name *Cryptocotyle*, hitherto regarded as a synonym of *Tocotrema*, might conveniently be applied. Lühe took *Distomum concavum* as type, while the genus *Tocotrema* is founded on *Distomum lingua* as type.

Tocotrema jejunum, sp. n.

This species occurred fairly frequently in *Totanus calidris*. It is of somewhat smaller size than *T. lingua*, the length varying from .87-1.77 mm., but the normal length is probably not beyond 1.3 mm. It displays, however, an extraordinary amount of extensibility. Almost every example was well extended, and in a large number the extension was so great that they had almost the appearance of threads, the body being often bent and twisted in a grotesque fashion. As might be expected, the maximum breadth occurring in the posterior part of the body is not at all constant, varying from $\frac{1}{2}$ to $\frac{1}{3}$ of the body-length. The normal figure is probably about $\frac{1}{5}$, being found in examples of 1.0 mm. to 1.2 mm. long. The shape is not like that of *T. lingua*, the anterior part of the body being more tapering and the posterior part more rounded. In a normal specimen (1.0-1.2 mm.) the oral sucker measures .045 mm. The ventral

sucker, as in *T. lingua*, is small and is situated within the anterior part of the genital sucker. The latter has a transverse diameter of $\cdot 055$ mm. It is placed about the middle of the body, slightly nearer the posterior end. The pharynx has an almost constant size of $\cdot 038 \times \cdot 018$ mm.; the pre-pharynx is somewhat shorter. The œsophagus varies from $\cdot 06$ mm. in a contracted specimen to $\cdot 14$ mm. in an extended one. The average may be taken as $\cdot 10$ mm., or nearly $\frac{1}{12}$ of the body-length. It is therefore longer than in *T. lingua*. The intestinal diverticula are much the same as in the latter. The excretory system is also similar. The cuticle is entirely covered with scales, with the exception of a small part at the posterior extremity.

The testes have the same situation as in *Tocotrema lingua*. They are irregularly oval, with indentations on their posterior border, and they are so placed that their long axes are almost at right angles to each other. The yolk-glands have also a similar position, but they are not so extensive. As far forward as the genital sucker their situation is purely lateral, but at this level they bend in on each side and form a complete arch in front of the ventral sucker. The anterior lateral prolongations found in *T. lingua* are not present here. The ovary is a small, roughly oval, lobed body, lying a short distance in front of the testes on the right side of the middle line. A receptaculum seminis is present in the middle line between the ovary and testes. It is of variable size, being sometimes smaller and sometimes much larger than the ovary. The uterus lies between the testes and the genital sucker and laterally does not extend much beyond the intestinal diverticula. It has the appearance which is characteristic of *Tocotrema lingua*, owing to its being arranged in three fairly regular transverse convolutions. The ova are numerous and of a light brown colour. They have a distinctive shape, pointed at one end, much broader at the other. They differ in this respect from those of *T. lingua*, which are more nearly elliptical. The most important feature distinguishing the two species is the size of the ova. Jägerskiöld gives the size in *T. lingua* as $\cdot 048 \times \cdot 022$ mm., which I am able to confirm; in *T. jejunum* the size is only $\cdot 031\text{--}\cdot 036 \times \cdot 016\text{--}\cdot 019$ mm., the average being $\cdot 033 \times \cdot 017$ mm.

In this species the vesicula seminalis is even more voluminous than in *T. lingua*. It extends back as far as the anterior testis and is highly convoluted. At its anterior end it becomes distinctly constricted and passes into the pars prostatica. This is a large pear-shaped body, enclosed by a

distinct membrane. It is situated in the long axis of the body; broad posteriorly, tapering gradually forwards.

There is some resemblance between this species and *Distomum Muehlingi*. They are about the same size and their ova are equal, but apart from the questionable presence of a genital sucker in *D. Muehlingi*, it displays the following differences:—The outline of the body is constricted in the middle; the œsophagus is much longer; the yolk-glands do not extend in front of the ventral sucker, but are more voluminous posteriorly, uniting between the testes, which are some distance apart; the ovary is rounded; the vesicula seminalis is not voluminous; and the ova are few.

Tocotrema lingua (Crepl.).

I have already frequently referred to this species and to Jägerskiöld's excellent note on it*. It is a very common parasite of the herring-gull, its favourite habitat being the anterior end of the intestine, particularly the duodenum. In addition a new host, *Alca torda*, must be mentioned. Only one bird of this species was examined, and it yielded but a single example of the parasite, so that its occurrence may be no more than casual. It is a small specimen about 1 mm. long, with few ova, but it is undoubtedly identical with the specimens from the herring-gull.

The numerous specimens from *Larus argentatus* show a remarkable uniformity in size. The length varies from 1·5 mm. to 1·8 mm., while the maximum breadth is rather less than $\frac{1}{3}$ of the length, and occurs usually in the anterior part of the body, giving the outline the familiar tongue-shape. Occasionally the anterior part is more tapering. The cuticular scales cover only the anterior part of the body, but they extend somewhat further back than Jägerskiöld represents them. The oral sucker has a diameter of ·075–·085 mm., and the ventral sucker appears to be nearly of the same size, although it is difficult to measure the latter owing to the absence of a limiting membrane. The pharynx measures ·06 × ·045 mm., and the short prepharynx is about $\frac{1}{4}$ as long. The œsophagus is extremely short (·04–·06 mm.), being not more than $\frac{1}{25}$ of the body-length. Jägerskiöld's statement that it never exceeds $\frac{1}{5}$ of the body-length seems to be an oversight, for it never in any circumstances approaches near that length, and in his figure, which is quite correct, it is not more than $\frac{1}{30}$. It is thus much shorter than that of *T. jejunum* or *Distomum Muehlingi*.

* Bergens Mus. Aarbog, 1898, no. ii.

Jägerskiöld's description of the structure of the genital sucker is accurate enough, but his representation in fig. 1 does not give a true idea of its external appearance. Three main groups of muscle-fibres are seen: (1) those forming the genital cup itself, consisting of radial and circular fibres; (2) those forming the ventral sucker, consisting almost entirely of radial fibres; (3) those associated with the common aperture. These are situated almost entirely in front of the aperture, very few fibres passing backwards. Two well-marked circular bands corresponding to Jägerskiöld's HQM, VQM, fig. 2, pass almost three-quarters round the aperture. In addition from the sides and anterior border of the aperture there pass out numerous radial fibres. Of these the lateral fibres become lost in the surrounding tissue, but the anterior fibres pass over and round the ventral sucker and seem to have a certain degree of connection with it. The ventral sucker is almost separated from the genital sucker by a constriction partly surrounded by a sort of sphincter. In extended states of the animal the passage between the ventral sucker and the genital cup appears as a narrow tube.

The vesicula seminalis is more voluminous than Jägerskiöld has it. It does not reach as far back as the ovary. At its anterior end there is a distinct constriction where it passes into the pars prostatica. The latter forms an almost semicircular (U-shaped) loop directed backwards. The ascending limb narrows gradually into the ductus ejaculatorius, which passes straight forward to the genital sucker.

The ova measure $\cdot 047\text{--}\cdot 049 \times \cdot 022\text{--}\cdot 025$ mm.

GENUS CRYPTOCOTYLE (Lühe).

Lühe gives no definition of this genus, so I offer the following:—

Body flattened, expanded; outline oval, slightly pointed anteriorly, rounded posteriorly, margin usually irregularly crenated. Cuticle entirely covered with small scales. Ventral sucker small, situated within the large genital sucker, and only slightly differentiated from it. Cavity of genital sucker simple, with no "plug-shaped body." Vesicula seminalis not very voluminous; pars prostatica? Testes side by side, symmetrical near hind end of body; posterior border more or less indented. Receptaculum seminis well developed; Laurer's canal? Ovary irregular, lobed, on right or left side of middle line. Uterus between testes and genital sucker forming two or more transverse folds which stretch between


the intestinal diverticula (but not beyond them). Ova not very numerous, light brown, thick-shelled, measuring about $\cdot 036 \times \cdot 019$ mm. Yolk-glands, alimentary system, and excretory system as in *Tocotrema*.

Looss's subfamily Cœnogoniminae appears too heterogeneous to constitute a natural subfamily. It seems to have much more the comprehensiveness of a true family, which might be designated Cœnogonimidae (or Cotylogonimidae, if, as Braun holds, Lühe's name *Cotylogonimus* has priority). Moreover, Looss's definition of his subfamily does not cover the forms which he includes within it. For instance, the following terms do not apply to the genera *Tocotrema*, *Cryptocotyle*, and *Scaphanocephalus*:—"Body distinctly divided into narrow anterior part and plumper posterior part; genital aperture in front of, or sideways from, the ventral sucker; long axes of testes transverse to long axis of body; ovary globular; windings of uterus extend laterally to near the edges of the body; ova $\cdot 02$ - $\cdot 03$ mm. long." That such a family as the Cœnogonimidae exists there can be little doubt, but it is not easy to define its exact limits. Much depends on which features are considered of greatest importance. The genus *Ascocotyle* appears to indicate a relationship with the Brachycœliinae, and it is quite possible that the latter, along with the genera *Spelotrema*, *Levinseniella*, and *Gymnophallus*, might be included in the same family. The genera *Tocotrema*, *Cryptocotyle*, and *Scaphanocephalus*, Jägersk., represent the furthest stage which the approximation of the genital aperture with the ventral sucker has reached. They form the nucleus of a subfamily, for which the name Tocotreminae, n. subfam., is appropriate.

Cryptocotyle concavum (Crepl.) ?

This form occurred very numerously in *Phalacrocorax graculus*; over a hundred examples were taken from one bird. The favourite habitat is the anterior part of the intestine and the duodenum. *Distomum concavum* has been recorded by several observers from a large number of hosts. Mühlhng's description of the species is the most exhaustive, and he was the first to discover the true nature of the genital sucker, but my specimens do not entirely coincide with his description.

A prepharynx is not entirely absent, but is short, being only $\frac{1}{5}$ of the length of the pharynx. The œsophagus is also slightly shorter than the pharynx, and thus much shorter

than Mühling has it. The peculiar inward bend of the intestinal diverticula as they approach the genital sucker is a constant feature, as is also their inward inclination at their termination. The yolk-glands are, as a rule, somewhat more voluminous than Mühling represents them, and occasionally form a continuous arch in front of the genital sucker. The yolk-ducts pass along the anterior border of the testes, and unite in a receptacle of variable size a little to the left of the middle line. The receptacle is capable of comparatively enormous dilatation. The fairly large, oval receptaculum seminis is situated immediately in front of the testes in the middle line. The testes are much as Mühling represents them and measure $\cdot 18\text{--}\cdot 26 \times \cdot 11\text{--}\cdot 16$ mm. With regard to the situation and shape of the ovary, my observations disagree entirely with those of Mühling. In my specimens it occurs on the right side of the body, directly in front of the right testis. It has the form of a scalene triangle, the longest side facing forwards; the shortest side lies along the receptaculum seminis, while the third side is parallel to and almost contiguous with the anterior border of the right testis. The latter sides are regularly lobed, there being four or five lobes on the side next the testis and two or three on that next the receptaculum seminis. The lobes are not of great depth. The anterior face is more even. The uterus has a characteristic appearance. It makes first a short turn to the left, then stretches across the body to the right side, whence it bends back again to the left side, and turning forward proceeds to the genital sucker. Its shape is therefore -like, with two short turns at the ends of the limbs. It never extends over the intestinal diverticula. In Mühling's figure the uterus traverses the body four times. The ova are not very numerous, light brown in colour, with a thick shell. They are more pointed at one pole than appears from Mühling's representation. Their size is $\cdot 034\text{--}\cdot 037 \times \cdot 018\text{--}\cdot 019$ mm.

Putting aside the possibility of error on Mühling's part, which does not seem likely, only two alternatives remain: we have here to deal with a case of "situs inversus" of the ovary, which is not uncommon in certain species, or my specimens must represent a distinct variety or species. To elucidate the matter I examined more than fifty examples and succeeded in finding one with the ovary on the left side, the bend of the uterus directed towards the same side and the yolk-receptacle on the right. Even then it did not resemble Mühling's figure, for the ovary retained its characteristic shape, the yolk-receptacle was on the opposite side

of the body, and the uterus traversed the body only twice. The possibility of amphitypy and slight error on Mühlings part causes me to hesitate in separating my specimens specifically from *Distomum concavum*. I therefore include them under that species for the present, in the hope that further investigation will prove them identical or distinct.

My specimens varied in length from .68 mm. to 1.06 mm., and in breadth .40-.66 mm., the average size being $.81 \times .54$ mm. The maximum breadth is therefore $\frac{2}{3}$ of the length. The oral sucker has an average diameter of .060 mm., and the genital sucker measures $.15 \times .11$ mm. The size of the ovary is about $.13 \times .07$ mm.

Genus GYMNOPHALLUS, Odhner.

Gymnophallus dapsilis, sp. n.

Occurred frequently in the Bursa Fabricii of *Oidemia fusca* and *Oidemia nigra*. It resembles in its habitat and in other respects *Gymn. bursicola*, Odhn., from *Somateria mollissima*.

It differs from all other species of the genus in having the yolk-glands in front of the ventral sucker, and this is the principal difference between it and *Gymn. bursicola*. Mature specimens varied in length from .84 mm. to 1.13 mm., the average being very approximately 1 mm., and, in fact, most of the examples varied but little from that size. One specimen .75 mm. long contained ova, but it was an exception. Immature forms were found as small as .68 mm. The maximum breadth at about the middle of the body was .45-.80 mm., average .63 mm., or nearly $\frac{2}{3}$ of the length. The general outline is a regular oval with rounded ends. The cuticle is entirely covered with sharp scales, .006 mm. long; it gives the body a firm consistency and when ruptured by pressure the fracture is sharp.

The oral sucker is circular, with a diameter of .16-.21 mm., *i. e.*, about $\frac{1}{5}$ of the body-length. The ventral sucker is smaller, .14-.17 mm., and lies almost exactly $\frac{1}{3}$ of the body-length from the posterior end. In immature specimens the suckers tend to be more nearly equal. The pharynx is continuous with the mouth and is almost circular in outline, with a diameter of .068-.087 mm. The œsophagus is about the same length as the pharynx. The diverticula are short and wide and extend very slightly beyond the middle of the body. The excretory vesicle resembles that of *Gymn. bursicola*, but the bifurcation is nearer the ventral sucker. The limbs end near the edge of the body at the level of the pharynx.

The testes are small longitudinally oval bodies, situated to the outer side of the excretory tubes and on a level with the posterior border of the ventral sucker or slightly further forward. They are symmetrical about the middle line and measure $\cdot11 \times \cdot08$ mm. The ovary is a short distance in front of the right testis, on the level of the anterior border of the ventral sucker. It is round and slightly larger than the testes. The position of the yolk-glands is almost invariably in front of and dorsal to the ventral sucker. Occasionally they are a little further back, but in only one instance were they found beyond the centre of the sucker. They are symmetrical about the middle line and consist of a number of small loosely-knit follicles.

The uterus is confined to the space between the two suckers. In one case out of sixty a few ova were observed behind the ventral sucker on the left side, and this was the case in which the yolk-glands were so far back, thus it must be regarded as abnormal. The ova are light yellow and fairly numerous. They present one of the most peculiar features of the animal, and it is surprising that no mention has been made of a similar peculiarity in connection with the other species of the genus. It consists in the presence in the same specimen of ova of very different sizes, the largest being as much as eight times the size (volume) of the smallest. This, moreover, is not a rare occurrence, but is to be met with in almost every other specimen. In several instances hardly any two ova were of the same size, and almost every length between a minimum of $\cdot012$ mm. and a maximum of $\cdot031$ mm. was observed. The smallest ova displayed a fairly constant size of $\cdot012 \times \cdot009$ mm., while what may be assumed to be the normal ovum (*i. e.* such as was found in an example possessing ova of nearly uniform size) measured $\cdot025\text{--}\cdot031 \times \cdot017\text{--}\cdot019$ mm. This corresponds fairly well with the size of the ova in *G. bursicola*. No explanation of this apparent vagary suggests itself at present; the phenomenon is unique, to my knowledge. It can hardly be the case that the ova when first formed are of small size and grow in the course of their passage through the uterus, for the small ova are found throughout the latter even near its termination; in addition the shell is of a bright yellow colour, which is not usually the case in newly-formed ova. Many large colourless ova are also sometimes to be seen in the vicinity of the ovary. The condition is much more probably pathological, but its occurrence in so many specimens seems opposed to this view.

The vesicula seminalis is a large ovoid body on the left of

and slightly overlapping the ventral sucker. It is on the same level as the ovary. The pars prostatica is also of considerable size; it lies directly in front of the ventral sucker, obscured to some extent by the yolk-glands.

From the foregoing it is apparent that this species, while bearing a close resemblance to *G. bursicola*, Odhner, has at least half a dozen constant features of difference. This species has some claim to be considered as the adult of the pearl-forming Trematode of *Mytilus edulis*. Odhner* has a note on this subject in which he criticizes Jameson's † observations. He shows that the specimens which the latter obtained from *Oidemias nigra* and identified with *Distomum somateriae*, Levins., belong, at least in part, more probably to *Gymn. bursicola*. He also corrects Jameson's obvious error that such small specimens as he found could be the adults of the large cercariæ in the mussel. He considers *Gymn. bursicola* as the most probable adult of these cercariæ, and there is no reason why this should not be the case. The claims, however, of this new species appear equally strong. Its dimensions allow for a fair increase in size in attaining maturity, while the immature specimens obtained in *Oidemias fusca* are only a little larger than the cercariæ in *Mytilus*. The difficulty ‡ of proving the identity of the sporocyst stage in *Cardium edule* and *Tapes pullastra* with the cercariæ in *Mytilus* still remains, and it is quite possible that they may be distinct. There must be at least six or seven distinct cercariæ of this type to correspond with the number of species of the genus *Gymnophallus*.

GENUS MARITREMA, gen. nov.

Body flattened, leaf-like, more or less elongated oval, sometimes tongue-shaped. Anterior end usually somewhat more pointed than posterior end. Cuticle provided with minute scales over a considerable extent. Suckers small and nearly equal; the ventral sucker is situated about the middle of the body. The intestinal diverticula may be short and sac-like or more elongated and narrow, but in no case do they extend beyond the testes; the bifurcation takes place nearer the ventral than the oral sucker. The excretory system (in *Maritrema gratiosum*) consists of a small vesicle from which two narrow tubules run forward; in front of the intestinal bifurcation they begin to widen and bend in

* Fauna Arctica, iv. (2) p. 312.

† Proc. Zool. Soc. 1902, i. pp. 151-160.

‡ Vide Ann. & Mag. Nat. Hist. (7) xvii. p. 151.

towards the middle line. Just in front of the pharynx they unite in the middle line, forming a wide commissure. From this a short wide branch runs forward on each side. Ovary situated immediately behind the ventral sucker, median or somewhat to the right; it has a characteristic trilobate outline, the base facing outwards and the apex median. Uterus very voluminous, occupying the greater part of the body behind ovary, but not extending in front of the latter. Ova numerous, oval, colourless on left side of body, yellow on right. Size $\cdot 016\text{--}022 \times \cdot 008\text{--}012$ mm. Yolk-glands of limited extent, confined to a fringe along the edge of the posterior part of the body. At the level of the testes this fringe bends inwards, passing along the anterior border of testes to unite in the middle line, so that almost a complete circle is formed. Receptaculum seminis absent (?). Laurer's canal (?). Testes symmetrical about the middle line, a little behind the ovary; outline oval, long axis usually transverse, sometimes decidedly oblique. Vesicula seminalis large, oval, on the right side of and close to the ventral sucker, behind which it extends some distance. It is enclosed in a well-marked cirrus-pouch. This has a somewhat pear-shaped outline, narrowing in front of the vesicula seminalis. The narrow part contains a short pars prostatica and passes round in front of the ventral sucker. The genital aperture is on the left of the latter, a little behind the level of its anterior border. The vagina passes up on the left side of the sucker.

Habitat, the intestine of birds. Type, *Maritrema gratiosum*, sp. n., from *Pelidna alpina*. Other species, *M. lepidum*, sp. n., and *M. humile*, sp. n.

Maritrema gratiosum, sp. n.

This occurred frequently in large numbers in *Pelidna alpina* and *Aegialitis hiaticula*. A few immature specimens from *Larus ridibundus* and *Hematopus ostralegus* are probably best referred to this species, although they do not wholly agree with the mature examples. The habitat is most usually the anterior part of the intestine.

The body is flattened and somewhat elongated, with a tendency to assume a tongue-like outline. There is usually a slight constriction near the level of the ventral sucker. The length varies from $\cdot 45$ mm. to $1\cdot 10$ mm., the maximum breadth from $\cdot 24$ mm. to $\cdot 44$ mm., or $\frac{1}{3}$ – $\frac{1}{2}$ of the length. As in *Spelotrema* species, considerable difficulty was experienced in determining the relative sizes of the suckers. Of the

specimens measured about 60 per cent. showed the oral sucker greater than the ventral, but taking the average of the figures obtained it was found that both approximated $\cdot 050$ mm. The limits in each case are $\cdot 043$ – $\cdot 062$ mm. The suckers are therefore very nearly equal, the oral sucker being usually a little the larger. In the immature specimens from *Hematopus* and *Larus ridibundus* the oral sucker is invariably distinctly greater. The oral sucker is subterminal and the ventral sucker is almost midway between the anterior and posterior ends of the body. The prepharynx is usually of considerable length, $\cdot 062$ mm. on an average, being nearly twice as long as the pharynx, which measures $\cdot 033 \times \cdot 016$ mm. In the *Hematopus* and *Larus* specimens the prepharynx was usually much shorter. The œsophagus measures $\cdot 06$ – $\cdot 16$ mm., being $\frac{1}{5}$ – $\frac{1}{7}$ of the body-length. The diverticula are more than twice as long, $\cdot 16$ – $\cdot 37$ mm., and this forms an important point of difference between this species and the other two species of the genus. They always extend as far back as the anterior border of the testes.

The ovary is situated immediately behind the ventral sucker, median or a little to the right. The characteristic trilobate outline is well marked. The uterus is so voluminous that its convolutions cannot be followed. It first fills the left side, where the ova are colourless, then passes to the right, where they are yellow in colour; the condition is thus the reverse of that in *Spelotrema*. The numerous ova measure $\cdot 020$ – $\cdot 022 \times \cdot 010$ – $\cdot 012$ mm. The yolk-glands have the situation and extent already noted in the definition of the genus, and this is constant for all three species. The testes are not overlapped by the uterus to any great extent, so that they are probably almost as thick as the body itself. Their outline is elongated oval, and their long axes are directed more or less obliquely upwards towards the middle line. In the specimens from *Larus ridibundus* the long axes are directly transverse, while in those from *Hematopus* the testes are almost globular. The shape and position of the cirrus-pouch have been noted in the definition of the genus. The vesicula seminalis within the pouch had a perfectly oval outline and is proportionately smaller in this species than in the other two. It does not extend much further back than the middle of the ovary. The terminal portion of the vagina has a sinuate course.

Maritrema lepidum, sp. n.

This occurred only in the intestine of *Larus argentatus*. It is about the same size as the previous species, but differs

in the following respects:—The suckers are proportionately larger and the oral sucker is distinctly greater than the ventral, their diameters being respectively $\cdot 068$ mm. and $\cdot 059$ mm. The ventral sucker is situated in front of the middle of the body. The pharynx is of the same size as that in *M. gratiosum*, but the prepharynx is shorter. The œsophagus is about the same length in both; the diverticula are here distinctly shorter, not extending beyond the level of the ventral sucker. They are straighter and wider, and are only $1\frac{1}{2}$ times the length of the œsophagus.

The ovary is the same as before, but always slightly to the right and somewhat smaller. The condition of the uterus is also similar; the ova are quite as numerous but smaller, measuring only $\cdot 018$ – $\cdot 019 \times \cdot 009$ – $\cdot 010$ mm. The testes are further forward, the right testis being almost contiguous with the ovary and the vesicula seminalis. Their long axes are always, so far as I have observed, directly transverse, and they are not overlapped by the uterus to any great extent. The vesicula seminalis is much larger, extending back as far as the anterior border of the right testis. The course of the vagina is distinctly Z-shaped.

Maritrema humile, sp. n.

This was found in large numbers in the intestine of *Totanus calidris*. It is a very small species, measuring only $\cdot 28$ – $\cdot 40$ mm. in length, with a maximum breadth of $\cdot 12$ – $\cdot 16$ mm. The cuticle is almost entirely covered with scales. Unlike the other two species, it has the oral sucker less than the ventral, the diameters being respectively $\cdot 025$ – $\cdot 031$ mm. and $\cdot 030$ – $\cdot 034$ mm. The ventral sucker is very nearly in the middle of the body. The pharynx measures $\cdot 019 \times \cdot 010$ mm., and the prepharynx is about the same length. The œsophagus is $\cdot 04$ – $\cdot 05$ mm. long, or nearly $\frac{1}{3}$ of the body-length, while the diverticula are almost twice as long. The latter are dilated, wide apart, and only reach the level of the anterior border of the ventral sucker.

The ovary, uterus, and yolk-glands are the same as in the other two species. The ova are still smaller than those of *M. lepidum*, being only $\cdot 016$ – $\cdot 018 \times \cdot 008$ – $\cdot 011$ mm. The testes are almost entirely enveloped by the uterus and their position is not obvious. They are symmetrical, transversely oval, and further back than in *M. lepidus*. The vesicula seminalis is a comparatively large structure, and the cirrus-pouch has exceptionally thick walls. It measures $\cdot 093 \times \cdot 032$ mm., and occasionally overlaps the ventral sucker to a considerable extent.

In connection with the above described three species it is interesting to read Jägerskiöld's note, in which he says:—"During my search for *Levinsenia brachysoma* I have found that there are quite a number of small Distomids, having the habitat of a *Levinsenia*, but so different in their copulatory organs that we are compelled to assign them to other genera. Thus, for example, in the intestine of *Charadrius hiaticula* a small Trematode was found in great numbers, which on superficial examination might have been mistaken for a *Levinsenia* sp., but on closer inspection displayed a cirrus and a cirrus-pouch"*. I have no doubt that he had before him members of the genus *Maritrema*, and in particular *M. gratiosum* and *M. humile*.

Equally interesting is the occurrence in *Paludetrina stagnalis* of two cercariæ, *C. oocysta* and *C. pirum*, first discovered and described by Miss Lebour †. These show very close resemblance to species of the genus *Maritrema*. *C. oocysta* shows well-marked testes, ovary, and cirrus-pouch, and has thus reached a very advanced stage of development for a cercaria. In many respects it agrees closely with *Maritrema humile*, but the fact that the oral sucker is greater than the ventral seems opposed to its identification as the larval form of that species. *Cercaria pirum* has not attained such a degree of development, there being no evidence of genital organs, but the configuration of the alimentary and excretory systems leaves little doubt that it is the larva of some *Maritrema* species. The anterior commissure of the excretory system differs only from my description of a similar structure in *M. gratiosum* in being behind the pharynx instead of in front. The suckers are practically equal, which agrees with the condition in *M. gratiosum*, but the intestinal diverticula are shorter. It is thus impossible at this stage to identify the cercariæ with certainty, but there can be no doubt that they belong to this or some closely allied genus.

GENUS PSILOSTOMUM, LOOSS.

Psilostomum brevicolle (Crepl.).

I have found this species not only in the intestine and cæca of *Hæmatopus ostralegus*, but frequently also in the intestine, cæca, and rectum of *Oidemia fusca*, and in the intestine of *O. nigra*. *Psilostomum oxyurum* (Crepl.) has

* Centralbl. f. Bakter. xxvii. p. 739.

† Trans. Nat. Hist. Soc. Northumberland &c., new series, vol. i. pt. 3, pp. 445-6.

already been recorded from *Oidemia nigra*, but this is, I believe, the first time that *P. brevicolle* has been met with in the scoters. The most recent note on the species is by Braun*, in the course of which he criticises Mueller's observations †. My specimens are small, 1.74-3.41 mm. long with a breadth of .35-.54 mm. They are somewhat cylindrical anteriorly, more flattened posteriorly, agreeing in this respect with Braun's specimens. The posterior end is usually rather blunt. With regard to the length of the neck (distance between centres of suckers, as I take it) my specimens are apparently much more extended than those of Mueller or Braun, for I find the proportion to be nearly constantly $\frac{1}{3}$ of the body-length, certainly never less than $\frac{1}{4}$, and in young examples much more. The constriction behind the ventral sucker is not a mere narrowing in the breadth, but is usually accompanied by distinct transverse annulation of the cuticle. The breadth here is only about half that at the widest part of the body. The oral sucker is slightly larger than the ventral. The latter is, as Braun says, usually deeper, although in extension of the anterior part of the body the oral sucker may be quite as deep. There is practically no prepharynx. The pharynx is almost globular, measuring .14-.21 \times .12-.22 mm.; it is thus somewhat larger than Braun has it. He is correct in saying that the œsophagus is extremely short, the bifurcation taking place almost immediately behind the pharynx.

The testes are contiguous or very nearly so, and the posterior is most often but not invariably the larger. With regard to the ova, there seem to be great variations in size although when the large size of the ova is taken into consideration the variation is not excessive. The observations of Mueller and Braun show an apparent discrepancy; the former gives the dimensions as .12-.13 \times .1 mm., the latter .104 \times .08 mm. This difference must result from the fact that Mueller had only measured the larger ova and Braun the smaller. With the view to explain this difficulty I measured the ova in upwards of 30 examples, and find the limits in length to be .100-.124 mm., and in breadth .052-.078 mm. These limits do not represent isolated examples, for all sizes between them were observed. The average figures are .1118 \times .0685 mm., but this does not imply that such a size is commoner than others. From this it is obvious that Mueller's figures, which are at best a rough approxima-

* Zool. Jahrb. Syst. xvi. pp. 12-13, pl. i. fig. 9.

† Arch. Naturg. lxiii. p. 19, pl. iii. fig. 2.

tion, are too high, and that Braun probably was contented with measuring a very few ova. Both find the breadth too great. These observations, I may add, were conducted almost entirely on specimens from *Hematopus*.

XXXIX.—*Preliminary Report on the Monaxonellida of the National Antarctic Expedition.* By R. KIRKPATRICK.

THE Monaxonellida brought home by the 'Discovery' include 43 species, of which 24 are new. Most of the specimens came from the neighbourhood of the Winter Quarters (lat. 77° 49' S., long. 167° 7' 4" E.).

Polymastia invaginata, sp. n.

Sponge hemispherical, free or attached, covered with a thick pile of pointed spicules; with one large oscular papilla usually completely invaginated, so that the summit of the oscule is on a level with, or below, the general surface. Under surface with a fleshy basal pad.

Colour in spirit pale yellow above, and often grey and semi-transparent on the under surface in free specimens. Consistence dense and firm.

Skeleton.—Choanosomal, formed of fibres curving upwards from the base to the periphery, penetrating the cortex, and forming the thick surface pile; with stellate groups of small tyles between the fibres.

Cortical skeleton formed of a dense layer of vertical tyles of various lengths embedded in a tough fibrous layer from .5 to 1.25 mm. thick.

Basal skeleton consisting of spicules transversely arranged, and crossing each other in an irregular manner.

Spicules.—Large, smooth, slightly curved styles, or occasionally strongyles, $2240 \times 40 \mu$.

Cortical tyles with small spheroidal head, short neck, fusiform straight shaft, varying in length from 140 to 350 μ , and in thickness from 12 to 19 μ . A few very slender styles scattered in the choanosome, $70 \times 6 \mu$, with head and neck making an angle with the shaft. Some medium-sized cortical tyles in the oscular papilla have long, oval heads. Tyles of the stellate clusters slender, with the head making an angle with the shaft, $200 \times 15 \mu$.

Localities. Winter Quarters, 10–30 fath.; off Mt. Erebus, 500 fath.